



## Groundwater Underflow Representation

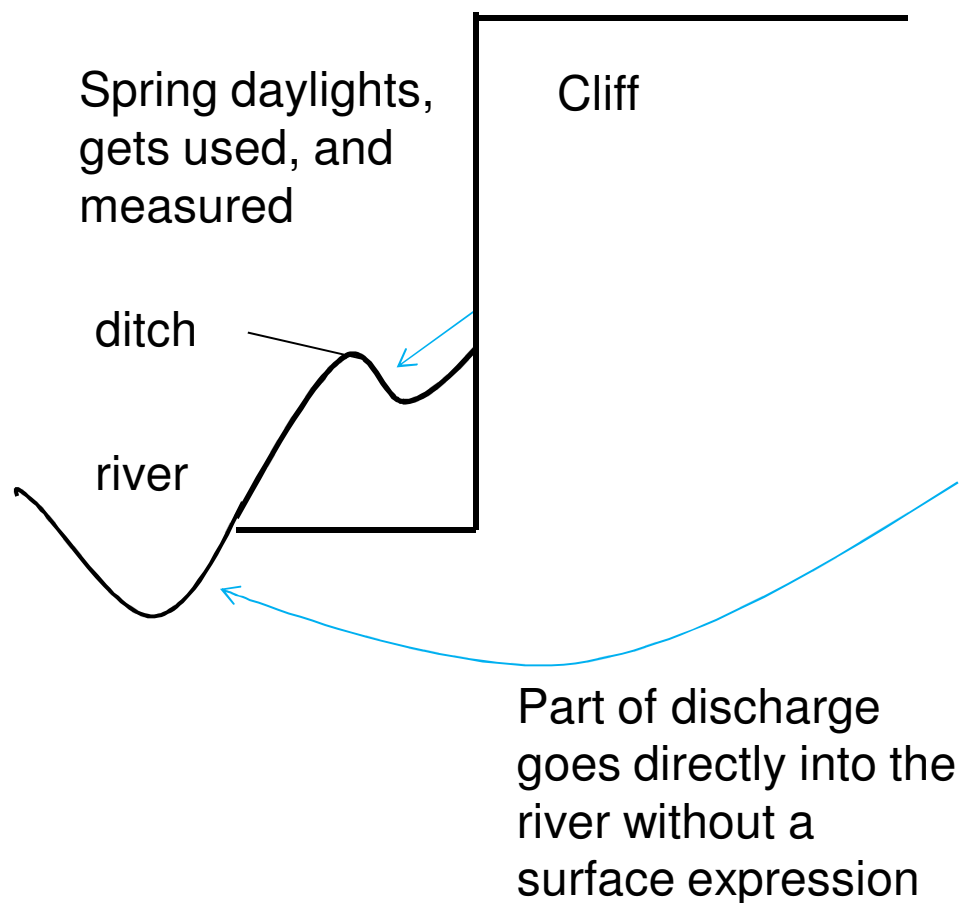
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23 January 2012

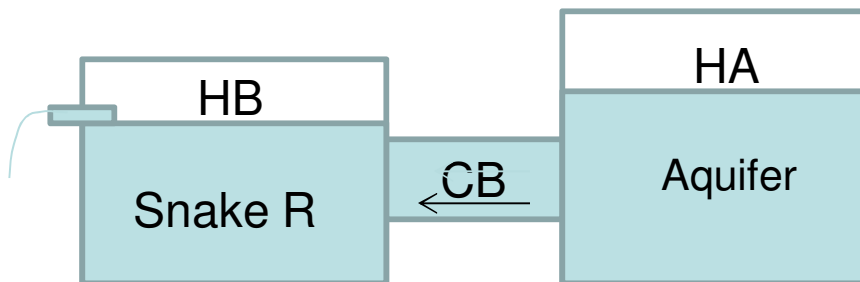
Allan Wylie IDWR



# Underflow



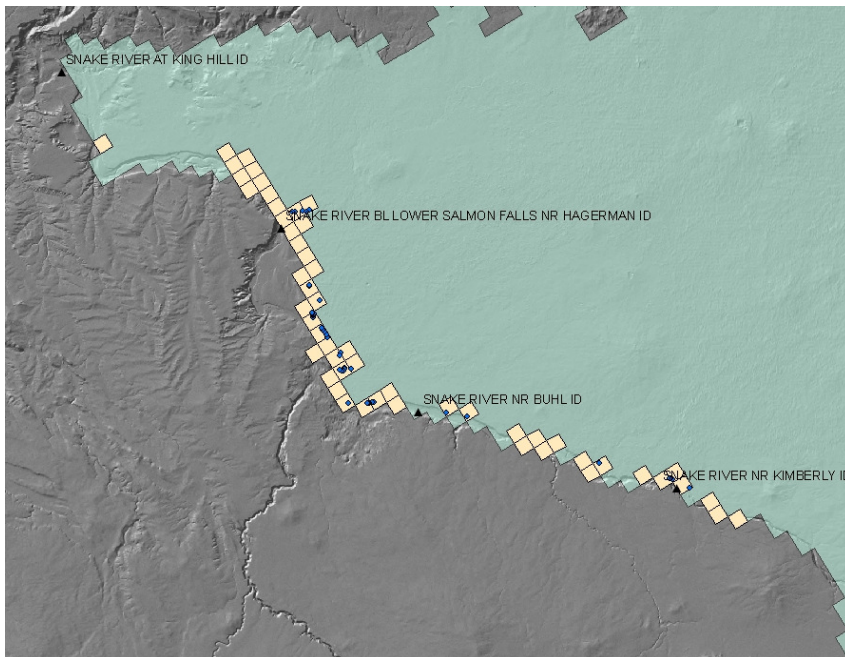
# General Head Boundary



- GHB
- $QB = CB(HB - HA)$ 
  - $QB$  = flux across boundary
  - $CB$  = boundary conductance
  - $HB$  = water level in Snake River
  - $HA$  = aquifer level

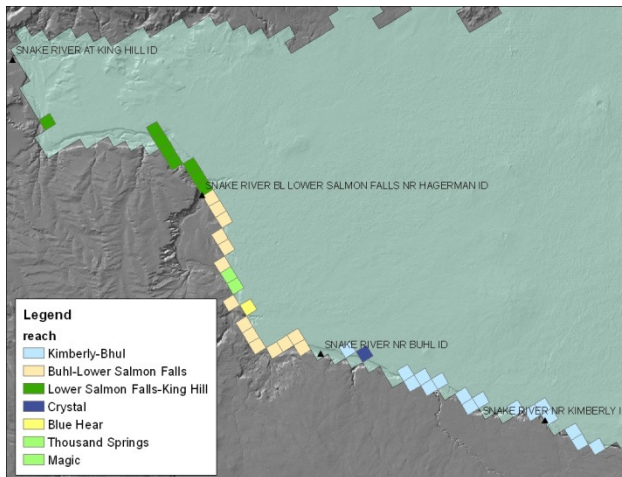


# Calculation of Underflow

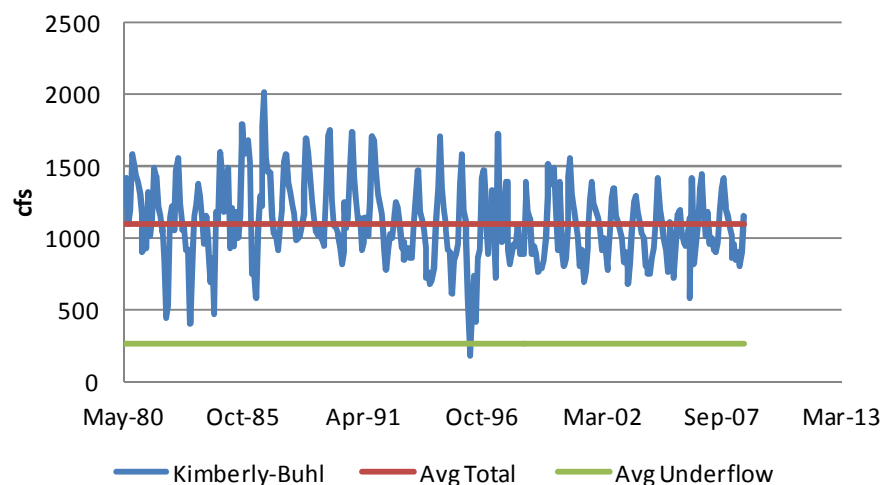


- Under flow = Average gain – (Average A&B springs + C&W springs)
- Underflow assigned GHB
- Assign underflow according to gaged river reaches
  - Kimberly – Buhl
  - Buhl – Lower Salmon Falls
  - Lower Salmon Falls – King Hill

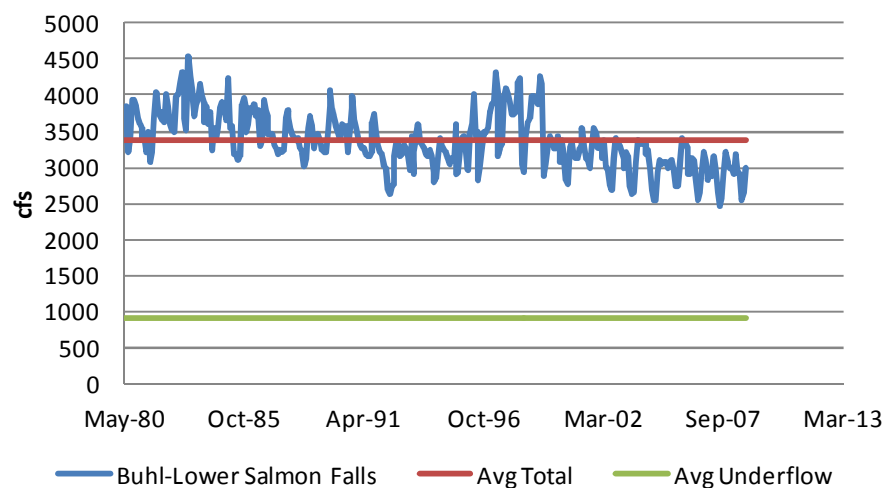
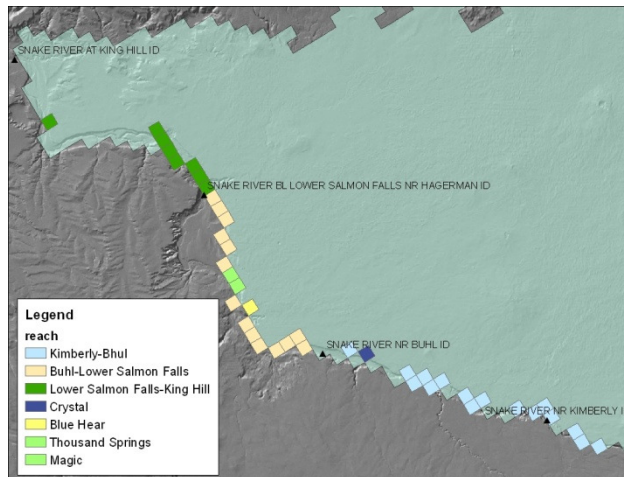
# Kimberly - Buhl



- Avg gain = 1104.5 cfs
- Avg A&B spg = 813.5 cfs
- Sum of C cells = 26.5 cfs
- $1104.5 - (813.5 + 26.5) =$   
**264.5 cfs**
- Crystal underflow =  
116 cfs

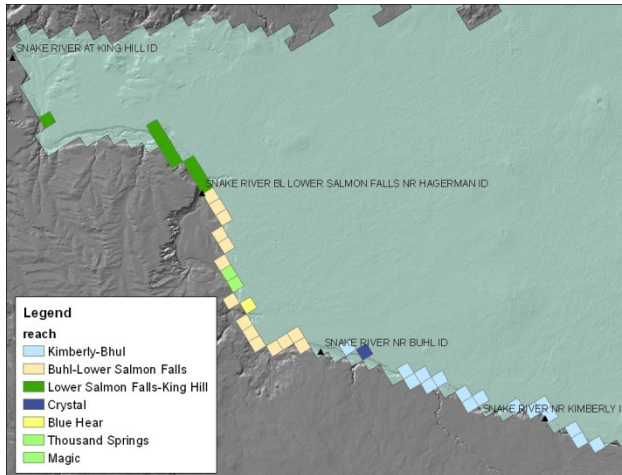


# Buhl – Lower Salmon Falls

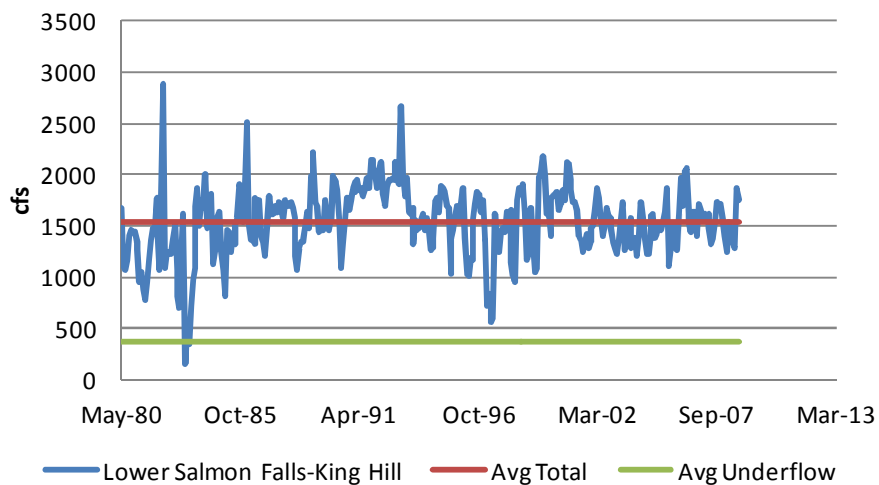


- Avg gain = 3370.4 cfs
- Avg A&B spgs = 2101.4 cfs
- Sum of C cells = 361.5 cfs
- $3370.4 - (2101.4 + 361.5) = \mathbf{907.5 \text{ cfs}}$ 
  - Thousand & Magic=494 cfs
  - Blue Heart=63.3 cfs

# Lower Salmon Falls – King Hill



- Avg gain = 1538.7 cfs
- Avg A&B spgs = 1070.5 cfs
- Sum of C cells = 102.8 cfs
- $1538.7 - (1070.5 + 102.8) = \mathbf{365.4 \text{ cfs}}$

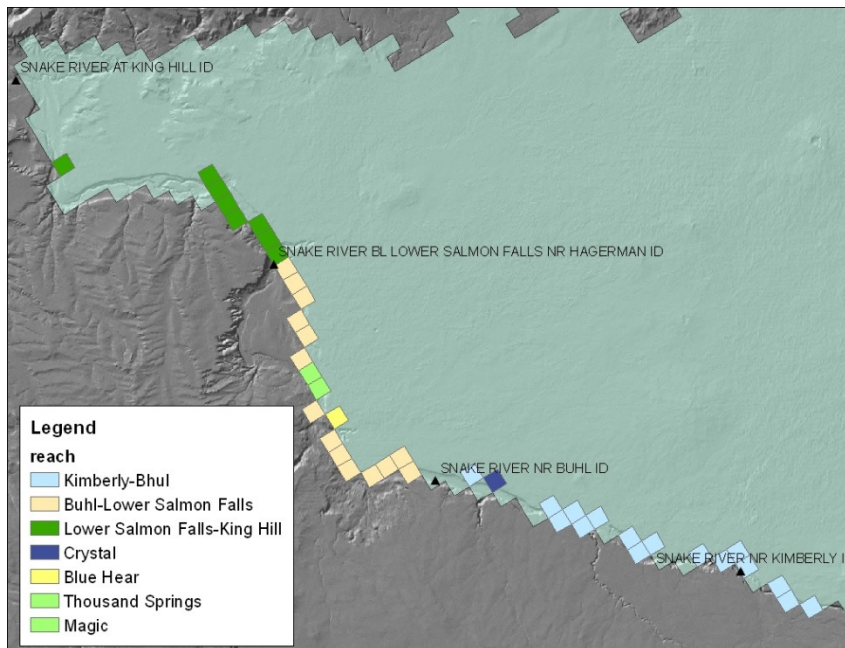


# Calculation of Underflow

Row Labels	Average Reach Gain cfs	Average A&B cfs	Sum of C cfs	Reach Underflow cfs
Kimberly-Buhl	1104.54	813.49	26.48	265
Buhl-Lower Salmon Falls	3370.39	2101.42	361.53	907
Lower Salmon Falls-King Hill	1538.74	1070.46	102.82	365
Total	6013.67	3985.37	490.83	1537.47



# Summary



- Kimberly-Buhl
  - 264.7 cfs underflow
  - Crystal = 116
- Buhl – Lower Salmon Falls
  - 907.5 cfs underflow
  - Thousand/Magic = 494 cfs
  - Blue Heart = 63.3 cfs
- Lower Salmon Falls – King Hill
  - 365.5 cfs underflow



END

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# Crystal Springs Underflow



- March 2011 USGS gaged Snake River above and below Crystal Springs
- Gain = 450 cfs +/- 45.90 cfs
- Typical Crystal discharge in March = 299 to 370 cfs
- Underflow:  
 $450 \text{ cfs} - 334 \text{ cfs} = 116 \text{ cfs}$

# Blue Heart Springs



- Buhl-Lower Salmon Falls reach
- USGS measurement in 1995 at 63.3 cfs
- Measured 4 other times between 1917 and 1968 discharges ranging from 61.5 cfs to 65.6 cfs
- Use 63.3 cfs



# Thousand Springs Underflow



- 14 USGS measurements at times when we have calibration data
- Assuming that underflow is the difference between USGS measurement and the sum of Thousand Springs cell and Magic Springs and the 5 cfs C&W estimated for cell 1045012
- Calculated underflows range from 224 to 765 cfs,
  - Average underflow = 494 cfs

